

CLAIMS

1. An electric propulsion system for a motor vehicle, comprising a fuel-cell stack (2) provided with at least one assembly of two electrodes (9, 10), each having an electrode inlet and outlet, and an electrolytic membrane (11) disposed between the two electrodes (9, 10), characterized in that the electrolytic membrane (11) contains conductive charges of protons distributed in a concentration gradient within the thickness of the membrane (11), in such a way that the water in liquid state produced by the fuel-cell stack is concentrated at one of the electrodes (9, 10), and in that the water in the liquid state concentrated in this way is evacuated from the fuel-cell stack via a single electrode outlet (14, 15).

2. A system according to claim 1, characterized in that the electrolytic membrane (11) is a multi-layer membrane.

3. A system according to claim 1 or 2, characterized in that the maximum concentration of conductive charges of the membrane (11) is situated on the same side as the anode (9), in such a way that the water in liquid state produced by the fuel-cell stack (2) is concentrated at the anode (9).

4. A system according to claim 1 or 2, characterized in that the maximum concentration of conductive charges of the membrane (11) is situated on the same side as the cathode (10), in such a way that the water in liquid state produced by the fuel-cell stack (2) is concentrated at the cathode (10).

5. A system according to any one of the preceding claims, characterized in that the said single electrode outlet (14, 15) of the fuel-cell stack (2) is connected to a single condenser (4).

6. A system according to claim 5, characterized in that the condensed water discharged from the condenser (4) feeds a reformer (5) capable of supplying hydrogen from a fuel to the fuel-cell stack (2).

7. A system according to claim 5 or 6, characterized in that

it additionally comprises a burner (3) connected to the anode (9) to recover the energy of the gases discharged from the anode (9).

8. A system according to claims 3, 5 and 7 taken together, characterized in that the burner (3) is disposed downstream from the condenser (4).

9. A method for using a fuel-cell stack (2) in an electric propulsion system for a motor vehicle, characterized in that it comprises the following successive main stages:

- concentration of the water in liquid state produced by the fuel-cell stack (2) at one of the electrodes (9, 10) by means of an electrolytic membrane (11) containing conductive charges of protons distributed in a concentration gradient within the thickness of the membrane (11),
- vaporization within this electrode (9, 10) of the water in liquid state concentrated in this way,
- condensation of the vaporized water in a condenser (4) connected to the outlet of the said electrode (9, 10),
- use of the water condensed in this way to feed a reformer (5) capable of generating hydrogen to feed the fuel-cell stack (2).

10. A vehicle provided with a system according to any one of claims 1 to 8, or a fuel-cell stack used by a method according to claim 9.